ity throughout the day, and therefore no idea regarding the actual temperature-humidity combinations can be obtained without making assumptions and computations.

Fedorov states in a footnote: "Perhaps it would be more natural to take the weather of a moment, but practically it is not satisfactory." However, this must be done; that it is practicable is shown in my previous paper and in the following article entitled "Frequencies of Weather Types at San Jose, Calif." Our unit is relatively simple, consisting of the instantaneous values of such elements as we may wish to consider. By analyzing observations taken at a regular time at a station we learn the frequencies of various types at that time of day for the month or other period desired. Conditions at other times of day are found by analyzing such other observations as may be desired and available.

Whether Federov's method or mine, or some other, shall be used in any particular study depends in part on the purpose in view; for instance, it appears that students of effects of weather upon human comfort and efficiency would prefer conditions in the morning, at noon, in the evening, etc., considered separately, by my method; while some botanical problems might be solved better by Fedorov's.

I have prepared diagrams according to Fedorov's scheme for San Jose, Calif., using data for the two months, January and July, 1926, separately. As might be expected, the number of types is intermediate between the numbers for Pavlovsk and Batavia. It is worthy of note, however, that an additional grade for daily range of temperature, above the highest used for Pavlovsk, was necessary; also that no thunder was recorded during either month considered, and that rain and frost occurred in the winter month only.

It is regretted that, on account of the impracticability of printing the necessary colors, none of the diagrams according to Fedorov's method is reproduced herewith.—*E. S. Nichols.*

Since the above summary and remarks were written Fedorov's paper has been published,[1] accompanied by diagrams in which shading is employed instead of colors for indicating cloudiness. While the diagrams are in this way not nearly so clear and striking as the originals, they are made suitable for reproduction in black and white. Figure 1, is a copy of the revised diagram for July at Pavlovsk, and Figure 2 has been prepared from San Jose data for July, 1926, according to the new method. It is suggested that if the reader will color Figures 1 and 2 in accordance with the original plan, he will obtain an adequate conception of Fedorov's scheme.—*E. S. Nichols.*

[1] "Das Wetter," 44 Jahrgang, Heft 6/7.

FREQUENCIES OF WEATHER TYPES AT SAN JOSE, CALIF.

By ESEK S. NICHOLS

[Weather Bureau, San Jose, Calif., November, 1926]

In accordance with my scale for classification of weather types (1), frequencies of various weather types at San Jose, Calif., have been determined from thrice-daily observations during the months of January, April, July, and October, for the five-year period, July, 1921, to April, 1926. Table 1, herewith, gives resulting data in tabular form; but conditions may be shown more clearly by a graphical method, which can be merely illustrated here, our space being limited. Classification begins with temperature and humidity, the importance of which is, therefore, emphasized.[1]

TABLE 1.—*Percentage frequencies of various weather types at San Jose, Calif., at thrice-daily observations during January, April, July, and October*

		H_{-2}			H_{-1}			H_0			H_{+1}			H_{+2}		
		W_0	W_1	W_2	W_0	W_1	W_2	W_0	W_1	W_2	W_0	W_1	W_2	W_0	W_1	W_2
January: 6:10 and 6:40 a. m. observations:																
T_{-1}	S_2				1			1			1			1	1	
	S_1													1		
	S_0							1	1		2	2	1	21	3	1
T_{-2}	S_2		1					2			2			31		
	S_1							1			1			7		
	S_0							1						16		
January (++): Noon observations:																
T_0	S_2		1	1	1			1								
	S_1					1		2	1		1					
	S_0	1						2	1		1					
T_{-1}	S_2	2	1		10	3		21	2	1	4					
	S_1				1	1		5	1	1	2					
	S_0		1		1			12	1		8	1		5	2	
T_{-2}	S_2															
	S_1															
	S_0													1		

[1] Temperature, relative humidity, wind velocity, and cloudiness are the meteorological elements used. Intervals are indicated on Figure No. 1 and in legends thereto; therefore the scale is not repeated here.

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TABLE 1.—*Percentage frequencies of various weather types at San Jose, Calif., at thrice-daily observations during January, April, July, and October*—Continued

		H_{-2}			H_{-1}			H_0			H_{+1}			H_{+2}		
		W_0	W_1	W_2	W_0	W_1	W_2	W_0	W_1	W_2	W_0	W_1	W_2	W_0	W_1	W_2
January (+++): 4:40 p. m. observations:																
T_0	S_2	1			3			1								
	S_1				1			1			1					
	S_0				1	1		1			1					
T_{-1}	S_2	1			13	1		21	5		2	2				
	S_1				1			4	2		2			1		
	S_0				1	1		7	2		9	1	1	7		1
T_{-2}	S_2		1													
	S_1															
	S_0													1		
April (++): 6:10 and 6:40 a. m. obvations:																
T_0	S_2										1			1		
	S_1															
	S_0									1						
T_{-1}	S_2							5	1		8			16		
	S_1				1			1			1			7		
	S_0							4			15	1		29	3	
T_{-2}	S_2										4			1		
	S_1															
	S_0															
April (+++): Noon observations:																
T_{+2}	S_2		1		1											
	S_1															
	S_0															
T_{+1}	S_2	1	3		4											
	S_1															
	S_0		1		1											
T_0	S_2	1	2		11	8		11	4							
	S_1				3	2		3	4							
	S_0				1			7	4	1				1		
T_{-1}	S_2					4	1	1	2							
	S_1					1		1	1							
	S_0				1	1		6	1		3		1	1	1	
April (++): 4:40 p. m. observations:																
T_{+2}	S_2				1	1										
	S_1															
	S_0															

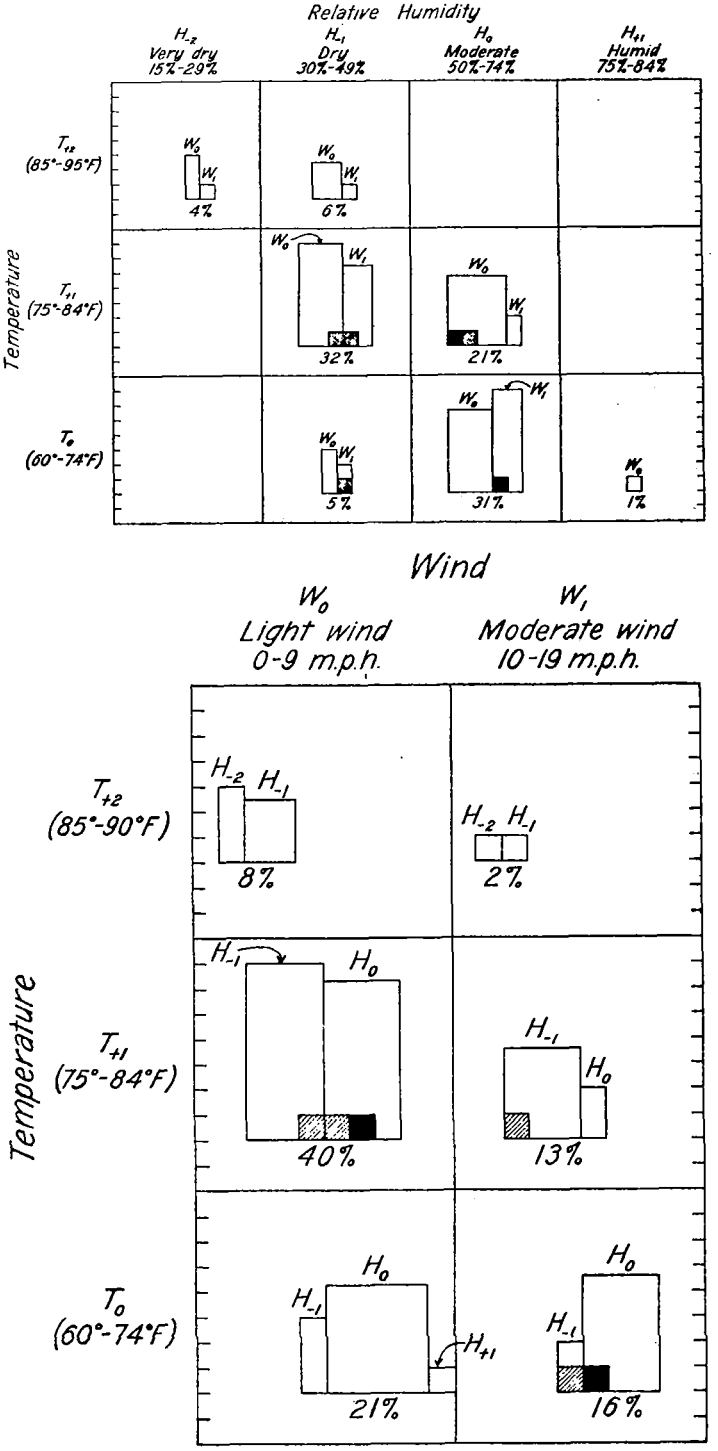
TABLE 1.—*Percentage frequencies of various weather types at San Jose, Calif., at thrice-daily observations during January, April, July, and October*—Continued

		H_{-2}			H_{-1}			H_0			H_{+1}			H_{+2}		
		W_0	W_1	W_2	W_0	W_1	W_2	W_0	W_1	W_2	W_0	W_1	W_2	W_0	W_1	W_2
April (++): 4:40 p. m. observations—Con.																
T_{+1}	S_2			3		4		1								
	S_1			1												
	S_0															
T_0	S_2		4			15		2	19							
	S_1				1	3		1	2							
	S_0				1	1		4	6	1	1				1	
T_{-1}	S_2					1	3		2	1						
	S_1					1	1	1	2							
	S_0					1		4	5		2	2		1		1
July (++): 6:10 and 6:40 a. m. observations:																
T_0	S_2							2	1		6	1		1		
	S_1							1			2					
	S_0							1			4	1		2		
T_{-1}	S_2							1			13	4	1	12	1	
	S_1										4	1		1	1	
	S_0							1			10	1		24	3	
July (+++): Noon observations:																
T_{+2}	S_2	3	1		5	1										
	S_1															
	S_0															
T_{+1}	S_2				20	10		17	2							
	S_1				1	1		1								
	S_0							1								
T_0	S_2				3	1		17	13		1					
	S_1					1										
	S_0								1							
July (++): 4:40 p. m. observations:																
T_{+2}	S_2		3		1	5										
	S_1															
	S_0															
T_{+1}	S_2		1		3	17			25							
	S_1								3							
	S_0															
T_0	S_2				1	8		3	35	1						
	S_1							1	2							
	S_0															
October (+++): 6:10 and 6:40 a. m. observations:																
T_0	S_2															
	S_1															
	S_0								1					1		
T_{-1}	S_2							5			7			28	1	
	S_1							1			2			4		
	S_0							1			5	1		37	2	
T_{-2}	S_2										1			3		
	S_1															
	S_0															
October (+++): Noon observations:[1]																
T_{+1}	S_2	7	1		3			1								
	S_1	1			1			1								
	S_0							1								
T_0	S_2				16	3		19	2		1					
	S_1		1		5	1		6	2		1					
	S_0				2			6	4			1		1	1	
T_{-1}	S_2										1					
	S_1							1	1		1					
	S_0				1			2			2			2		
October (+++): 4:40 p. m. observations:																
T_{+2}	S_2				1											
	S_1															
	S_0															
T_{+1}	S_2	3	1		5	1										
	S_1	1			1											
	S_0															
T_0	S_2		1		11	5		16	17		1	1				
	S_1				1	1		4	5							
	S_0				1			5	3		2			1		
T_{-1}	S_2							1	3							
	S_1								1							
	S_0							2			1	1		2	1	

[1] Also 1% $T_{+1}H_{-2}S_2W_1$.

Figure 1 is a diagram based on data in Table 1 for noon observations in July. On 10-by-10 cross-section paper as many columns of large squares are taken as there are humidity groups that occur, each column being headed to indicate a humidity group, in ascending order from left to right. Also, as many rows of large squares are taken as there are temperature groups to be represented, each row designated for a group in ascending order upward.

Then in each large square a figure is drawn, the area of which, measured in small squares, is proportional to the percentage frequency of the temperature-humidity group type indicated by the column and row in which the square lies; this percentage, for convenience, being entered below each figure. The total area of all the



figures and the sum of the percentages, for the group of squares used for any month, and observation, are in each case 100. Each figure is divided by vertical lines into sections, the areas of which are proportional to the frequencies of various wind-velocity conditions (indicated by the letter W with appropriate subscripts entered above each section, in accordance with the scale)

within the temperature-humidity groups. The temperature-humidity-wind types are further divided according to cloudiness, as indicated by shaded areas proportional to frequencies. Cloudy is indicated by black areas, clear by clear areas, and partly cloudy by crosshatching. Thus, since we find in the noon group of figures for July (reproduced as Figure 1) in the H_0 column, and the T_0 row a clear area covering 13 small squares under W_1, we see that 13 per cent of the cases at noon in July have temperature between 60° and 74° F., relative humidity between 50 and 74 per cent, clear sky, and wind velocity from 10 to 19 miles per hour.

If for any purpose it is desired to leave out of consideration any of the four meteorological elements used, the proper areas and percentages may be combined; this may be carried to the extent of eliminating all but any single desired element. In Figure 1 it is particularly easy to eliminate all but temperature and humidity by considering simply the percentage numbers on the face of the chart. Also, Table 1 is very convenient in combining and rearranging. We may readily rearrange our data so as to emphasize other elements than temperature and humidity. For instance, Dorno considers temperature and wind velocity more important in relation to human comfort (2); so in Figure 2 relative areas have been drawn for July noon data, using columns for wind velocity instead of for humidity, tabular percentage-frequency data having been properly rearranged accordingly. Of course, the details of the system may be modified, also, by changing the intervals used for any element, by substituting other elements for those employed, by the addition of other elements (such as intensity of radiation, atmospheric pressure, precipitation, etc.), and in other ways.

Thus, in his paper already mentioned, Dorno refers to the importance of considering departures of atmospheric temperature from that of the human body (36.5° C., 98.6° F.). Our temperature group T_{+3}, 96° to 105° F., includes temperatures at and near that referred to. Other type groups may be thought of as beint below or above the body temperature instead of being referred to zero of the usual scale.

If two days have the same sequence of weather types they may be said to have essentially the same weather. An examination of the regular thrice-daily observations taken at San Jose during July, 1926—apparently a month with fairly uniform weather—gave 28 different sequences for the 31 days. This illustrates the great complexity of the weather; any day is likely to differ from its neighbors, even when major features only are considered.

The principal purpose of this study is to show a method of indicating the atmospheric conditions that occur at a place. Having information in the form exemplified, it is possible for a person to tell with considerable accuracy how suitable a given climate would be for a given purpose, basing his conclusions upon his experiences with the various weather types elsewhere.

Furthermore, it should be possible to express numerically, and hence to appraise, the relative suitability of the different types for certain purposes. Thus, we might compute the rate of cooling of man under each type in accordance with the formula developed by Brooks and Donnelly (3) and (4).

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THE ST. LOUIS TORNADO OF SEPTEMBER 29, 1927

By MONTROSE W. HAYES, Meteorologist, U. S. Weather Bureau, St. Louis, Mo.

On September 29, 1927, at 1 p. m., a tornado moved across St. Louis, passed over the Mississippi River, and dissipated in Illinois, about 3½ miles from the river.

The weather map for 7 a. m., September 29, showed a barometric depression of considerable intensity over Nebraska and Kansas. Special observations at 1 p. m., the time of the occurrence of the storm, made in the Missouri and upper Mississippi Valleys, placed the center of the depression in western Iowa, exactly to the northwest of St. Louis, and 350 miles distant.

In St. Louis the day broke cloudy and rainy. Intermittent rain that began before daylight ended at 7:10 a. m. After the ending of the rain strato-cumulus clouds predominated, but during the forenoon the ceiling was broken and some alto-stratus clouds were visible. The sun shone for 25 minutes between 8 and 9 a. m. Shortly after 11 a. m. clouds became lower and thicker and rain began at 11:26 a. m. The rain was quite light for slightly more than an hour and a half. Low clouds were moving very rapidly from the southwest. At 12:41 p. m. lightning was seen and thunder was heard in the west. The thunderstorm rapidly overspread the west and southwest, and appeared to move to the northeast, its path being to the west of the Weather Bureau office. At 12:57 p. m. the clouds were very low, thick, and black. One large detached portion was particularly noticeable; it seemed very little above the high buildings and from the Weather Bureau office it was west of and slightly to the south of the Bell Telephone Building. Although this detached cloud was quite black and angry looking no boiling motion was apparent. The rain became heavy, in a sudden downpour, at 1:02 p. m., and the wind had increased to a very high velocity by 1 p. m. The low clouds, and the rain driven by the high wind, made a solid impenetrable grayish-brown mass outside the office windows (looking to the south and west), and vision from the windows was totally obscured from 1:02 p. m. to about 1.05 p. m., when the atmosphere grew lighter. The wind force decreased materially at 1:05 p. m., but the rain continued heavy until 1:13 p. m. A special observation was begun at 1 p. m., but on account of the dark deluge of water through the instrument shelter the instruments could not be read; they were eventually read at 1:06 p. m.

The wind was strong from the southwest after 6 a. m.; at 12:35 p. m. it backed to the south, but occasionally veered to the southwest, and was not quite so strong. At 12:56 p. m. it came steadily from the south and increased in force. At 1:02 p. m. it veered to the west and blew from that direction until 1:06 p. m., at which time it became west-northwest. The maximum velocity was at the rate of 70 miles an hour in the five minutes